New BEKON Biogas technology for dry fermentation in batch process (secured by various patents)

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Dry fermentation process for biogas generation

At the beginning of the 21st century a new market is opening up for the use of biogas technology in the production electrical and thermal energy from organic matter.

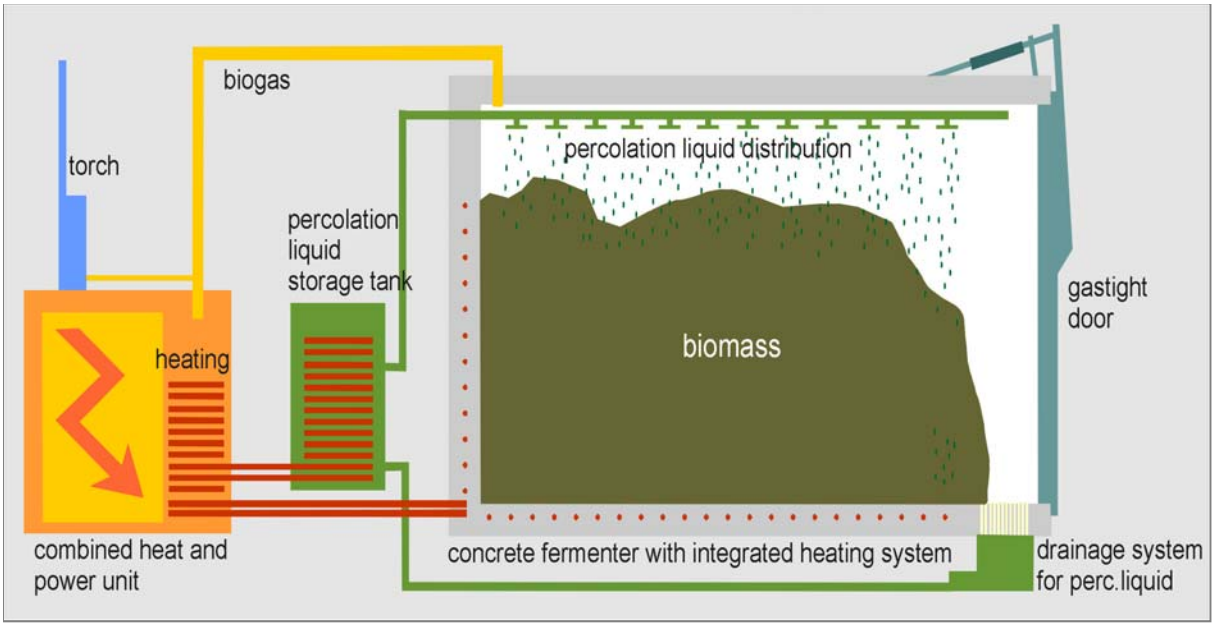
The technology of “dry fermentation” can generate energy from communal and agricultural organic matter / waste.

Up until now, biogas technology mainly concentrated on the ”wet fermentation” of agricultural and communal organic waste, while the recently patented BEKON dry fermentation process can produce methane from organic matter with a high content of dry matter. This kind of energy production is environmentally sound and economically interesting, while also creating and securing employment.

A great potential for energy generation from organic matter is found in agricultural by-products and wastes, communal organic waste and cuttings from coppicing and other maintenance work in the countryside and forests. With the dry fermentation process biogas with a high energy content is produced that can then be converted into electricity and heat in block-type thermal power stations.

Instead of disposing of organic matter from agriculture or communal waste in other ways, dry fermentation offers a means of turning it into a valuable resource and extracting the highest possible benefit from it (in the form of biogas, electricity, heat, compost and fertilizer). The high quality compost, which results from the process of dry fermentation, can be used as a valuable fertilizer for agricultural and horticultural purposes.

Process description of BEKON Biogas Technology



Batch Method for Biogas Generation

The BEKON dry fermentation process is a single-stage batch process for biogas generation from biomass with a high dry matter content.

The organic matter is inoculated with substrate that has already been fermented. It is then filled into the digester and fermented under airtight conditions. Continual inoculation with bacterial matter occurs through recirculation of percolation liquid, which is sprayed over the organic matter in the digester. No stirring of the organic matter is necessary during the dry fermentation process, as it is in conventional wet fermentation systems.

The temperature of the process and of the percolation liquid are regulated by a built-in floor heating system in the digester and a heat exchanger in the tank which acts as a reservoir for the percolation liquid.

The different stages of degradation (i.e. hydrolysis, acid and methane formation) take place in the same digester, which has a lot of advantages in comparison to other systems, where usually considerably more expense is involved in respect to the process itself and in respect to the mechanical technology behind it. This in turn has an adverse effect on process energy consumption and on maintenance costs.

➔ **The technology is characterised by its simple construction. Organic matter with a high dry matter content can be methanized.**

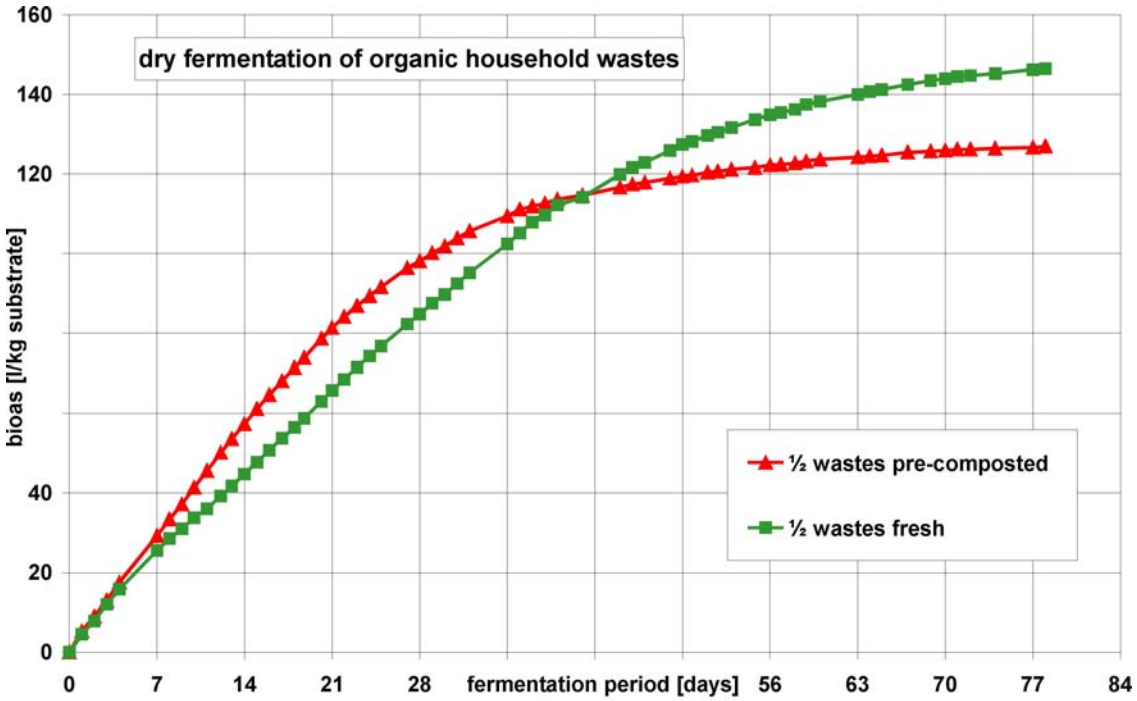
Low Process Energy Consumption

During the fermentation process, no further mixing, pumping or stirring is necessary inside the digester. Therefore, BEKON dry fermentation technology requires only a low input in respect to process and mechanical demands. In contrast, conventional liquid fermentation systems require a large amount of process energy during operation. The highly specialized and unique BEKON process technology of dry fermentation requires an extremely low energy input.

➔ **Dry fermentation has a low energy consumption compared to other systems.**

High Gas Yield and Excellent Gas Quality

The gas yields from the dry-fermentation of agricultural substrates correspond to the specifications given by the Bavarian Institute for Agricultural Technology in Munich/Weihenstephan. They vary, depending on the substrate, from 100 m³/t for meadow grass (first cut) to up to 180 m³/t for maize silage. For organic wastes, gas yields are similar to those of conventional liquid fermentation systems. The low sulphur and high methane contents in biogas from dry fermentation are particularly interesting features of this system.



➔ **Biogas yield from the dry fermentation system is about the same as in liquid fermentation systems.**

Compact Design with Safety Reserves

The digesters are made of gas-tight concrete and can be filled and emptied with a wheel loader or a front-end loader. The digesters are elongated and garage shaped, with a large gate at one end. After the biomass has been introduced, the gates are closed and shut gas-tight. The system is equipped with an especially developed safety device, preventing an explosive atmosphere from forming when the digester is opened for emptying and refilling.

➔ **Thanks to the high dry matter content of the substrate, the digesters feature a compact design.**

Computer Controlled Operation

Via a computer controlled system the treated percolation liquid is sprayed repeatedly over the organic matter. When necessary (according to the calculations of a monitoring device) the same system will automatically add lime for pH-stabilisation or other substances for optimising the process.

Optimal process temperature is regulated by the temperature of the percolation liquid and the floor heating in the digester via heat exchangers. The biogas production can be regulated by adjusting temperature within the digester.

➔ **The dry fermentation plant can be operated and controlled through user-defined, computerised process parameters.**

Heat and Power Generation

The biogas is dried in a gas-processing chamber, where gas quality and volume are measured. It is then pumped through a gas-regulating device, with the necessary safety installations, into a combined heat and power unit. An especially designed biogas gas engine in the co-generation unit generates electricity. Some of the excess heat is used to maintain optimum temperature in the digesters, but most is available for other uses.

➔ **Biogas is used in a co-generation unit for the production of electricity and heat.**

Other Possibilities for the Utilisation of Biogas

A further interesting development in the use of biogas will be its upgrading and adaptation to natural gas standards, so that it can be used in natural gas driven vehicles.

After upgrading the biogas produced, it would also be possible to feed it directly into the natural gas supply network. Specific quality standards for biogas as a substitute for natural gas have to be formulated by the operators of the gas supply network. In a few EU countries such strategies have already been successfully tested. In areas where the installation of a natural gas network is too expensive the installation of a local biogas supply network could become economically viable.

➔ **Biogas can be utilized as a natural gas substitute in gas driven vehicles, or for feeding into the natural gas supply network.**

Further Utilisation of the Digested Organic Matter

Once the fermentation process is finished, the digesters are emptied and the digested matter, with a decomposition grade of 2-3, can either undergo further composting or be spread directly onto fields.

➔ **The highly valuable compost can be utilized as a quality fertilizer by farmers, municipalities and in private and commercial gardening operations.**

Pilot project in Munich

Advantages of dry fermentation

- Utilisation of presently unused high-energy content substrates (green cuttings, solid manure, cuttings from coppicing and other park or countryside maintenance work etc.)
- Compact design of the plant thanks to a substrate with a high concentration of dry matter (up to 50 %)
- Low maintenance and noise-reduction costs, low investment costs for plant and mechanical devices

- Hardly any moving parts in the biogas plant itself, thus reducing the costs of wear and tear
- Highly developed. modern, computer-controlled system
- Low process energy consumption (less than 10 % of the energy produced in the co-generation unit)
- High, good quality gas yields (about 80 % methane content, about 20 ppm hydrogen sulphate, which makes desulphurisation generally unnecessary)
- Possibility of modular expansion
- Use of wheel loaders and front-end loaders to fill and empty the digesters, and therefore potential use of available equipment
- Simple process that allows a large variety of non-organic substances (sand, wood plastic etc.) in the substrate throughout the digesting process; interfering substances can be sieved out after digestion
- No costly storage of the digested substrates, as with liquid substances; cheaper transport costs.
- Additional income for waste disposers, municipalities, farmers
- Generation of a direct source of income in rural areas through highly valuable end products (electricity, heat, compost)
- Additional advantages compared to wet fermentation systems in countries where water is a limited resource
- Low maintenance requirements and robust technology, therefore particularly suitable for export
- Potentially contribution to reducing fossil fuel consumption and thus to combating climate change.

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